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Three Indo-Pacific Thelypteris Species Reinterpreted and a New African Species Described

F. R. FOSBERG

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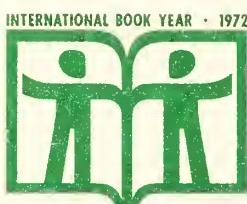
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and M.-H. Sachet

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ABSTRACT

Fosberg, F. R., and M.-H. Sachet. Three Indo-Pacific *Thelypteris* Species Reinterpreted and a New African Species Described. *Smithsonian Contributions to Botany*, number 8, 10 pages, 3 figures. 1972.—Two species of *Thelypteris* which have been confused and to which a number of names have been applied were found to be separable by a number of characters. They must now be called *Thelypteris opulenta* and *T. wagneri*. Their distribution is Indo-Pacific, extending to Africa, and *T. opulenta* introduced into tropical America. *T. wagneri* and an African species, *T. fadenii*, are here described as new. The name *Thelypteris interrupta*, heretofore applied to this complex, is shown to be the correct name for what has commonly been called *Dryopteris gongyloides* and *Thelypteris totta*.

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Three Indo-Pacific *Thelypteris* Species Reinterpreted and a New African Species Described

Among the common Indo-Pacific ferns are a pair of *Thelypteris* (*Cyclosorus*) species with lobed pinnae, nearly marginal sori, a sterile zone on both sides of the midrib of the pinna, and with at least a few, usually many, yellow particles (glands?) on the lower surface of the blade, especially on the lobes. They may be found in herbaria under many names, some properly applied to ferns of this relationship, others not. The present attempt to unravel the specific taxonomy and nomenclature of this group was stimulated by our realization that a plant of the Marquesas Islands, described by Dr. Elizabeth Brown as *Dryopteris sulfurea*, was apparently identical with what we had previously called *Dryopteris extensa* (Blume) Kuntze, or *Dryopteris interrupta* (Willd.) Ching, in Micronesia.

Since the latter two species were originally described from Java and India, respectively, it seemed appropriate to examine past treatments to determine what plants were originally so named. This survey showed considerable variation in opinions as to whether one or several species are involved and as to the names to be applied to them. The criteria by which they were separated also varied considerably, from author to author. Most of the purported differences are rather intangible—depth and shape of lobing, ranges of thickness and habit of rhizome,

abundance of yellow glands, and details of venation. An attempt to sort the available material from the western Pacific in the United States National Herbarium according to these criteria was not very successful, except to suggest a geographical separation of two entities. A further attempt on these lines, separating the Malesian from the Micronesian and Polynesian material, showed a reasonably consistent difference in the shapes of the leaf apices of the plants from these two regions. The Pacific specimens have the apical segment broad at base, pinnatifid or at least deeply lobed in the basal half, gradually attenuate distally into a caudate tip. Most of the specimens from the Malesian region have the apical segment essentially similar to the pinnae, linear-oblong, with one or two similar but reduced segments at its base, either separate from it or fused with it. These segments are abruptly much smaller than the next lower pinnae.

It is surprising that such a clear-cut difference apparently has not been used before to distinguish these plants. Those with the pinnatifid tip include all material seen from Polynesia and Micronesia and a few specimens from the Philippines, Malacca, Pulu Penang, Java, Rawak, Thailand, Ceylon, and westward to East Africa, and those from tropical America (introduced). They have most frequently been called *Nephrodium extensum* or *Dryopteris extensa*, but this epithet has also on occasion been applied to the other plant.

The plant with the linear-oblong terminal segment

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is found from New Guinea, the Malesian and Philippine Islands, westward to India and Ceylon, Central Africa and Fernando Po Island. It has commonly been called *Nephrodium* or *Dryopteris pteroides*, or more recently *Dryopteris interrupta* or *Cyclosorus interruptus*.

Whether we are dealing with two species or only with varieties of one is a difficult question. Most pteridologists, including Copeland and Holttum, have maintained the two as separate species, though not always on the same grounds. Wagner, in a manuscript on file in the U. S. National Herbarium Division of Ferns but apparently never published, regarded them as varieties of one. They are big, unwieldy ferns and not always fairly represented by herbarium material. Unfortunately, the rhizome is lacking on most specimens, making it difficult to apply the criterion that one has a short, thick erect or ascending rhizome with congested fronds, whereas the other has a more slender, creeping rhizome with scattered fronds. Our present impression is that this is not a very reliable difference, but that it does represent a real tendency.

Since the difference in the apical segment seems reasonably clear, and since that is supported by a number of less easy-to-use characters, and since the extensive geographical ranges have only partial overlap, we are for now regarding the two plants as separate species. Future studies on a more representative range of material may possibly show this to be wrong. In any event, the two form a closely related group, defined by yellow glands, lobing only part way to the costae of the pinnae, and marginal or submarginal positions of the sori, which are usually lacking in the united portions of the pinnae. The margins tend to be a bit revolute around the sori, making the lobes appear narrower and the sori more marginal than they really are. The indusia are well developed. The spores are bilateral and very deeply rugose with short curved or sigmoid ridges. The group seems related to the plant that is currently called *Thelypteris totta* (Thunb.) Schelpe or *T. goggilodus* (Schkuhr) Iwatsuki, which is discussed under *Thelypteris interrupta*. This may be only a superficial resemblance, due to the submarginal sori. The group with yellow glands has been confused with a number of other species, notably *T. pennigera* (Forst. f.) Allan and its close relatives.

The rest of this paper will attempt to sort out the synonymy and establish the correct names for the two species under discussion, and to discuss two other species that enter into the problem. Unfortunately, several of the synonyms are hard to place without authentic material. These are indicated by a query. All that are definitely included in the two synonymies, without a query, and not as "sensu" particular authors, are plants with the above combination of features that characterize the group.

The names that seem to have been based on plants of this affinity were all studied with reference to their original descriptions and types (when available), as well as to subsequent discussions of their typification, and in the light of the combinations of characters of the two species as indicated above. It was fairly easy to assign most of the synonyms to one or other of the two species, thus compiling the synonymies listed



FIGURE 1.—*Thelypteris opulenta*, portion of frond showing terminal segment and lobing of pinnae.



FIGURES 2 AND 3.—*Thelypteris wagneri*, portions of fronds showing terminal segment and lobing of pinnae.

under the species. Names that have been misapplied to these species are indicated as "sensu" the misapplying author, "non" the correct author of the name. Herbaria where the specimens cited were examined are indicated by the standard Index Herbariorum abbreviations except those still in our possession and not yet deposited, which are marked (Fo).

Thelypteris opulenta (Kaulf.) Fosb., new combination

Aspidium opulentum Kaulf., Enum. Fil. 238, 1824. Type: Guam, Chamiso.

Polystichum pennigerum sensu Gaud., Bot. Voy. Uran. 328, 1826, non *Polypodium pennigerum* Forst. f. 1786.

Nephrodium impressum Desv., Prodr. 259, 1827. Type: Timor, Hb. Desv.(P.).

Aspidium extensum Blume, Enum. Pl. Jav. 156, 1828. Type: Pulu Pinang, Blume.

Aspidium multijugum Wall., Cat. 348, 1829, nomen nudum.

Aspidium prionophyllum Wall., Cat. 355, 1829, nomen nudum.

Aspidium terminans Wall., Cat. 386, 1829, nomen nudum.

Nephrodium cumingii J. Smith in Hook., J. Bot. 3:411, 1841, nomen nudum.

Nephrodium terminans J. Smith, Bot. Mag. 72 (Comp.):32, 1846, nomen nudum.

Lastraea malaccensis Presl, Epim. Bot. 35, 1849 [1851]. Type: Malacca, Cuming 391.

Nephrodium conioneuron Féé, Gen. Fil. 308, 1852?

Nephrodium extensum (Blume) Moore, Ind. Fil. 91, 1858.

Aspidium pteroides vars. *a?*, *b* (pro parte), Mett., Ann. Mus. Lugd. Bat. 1:231, 1864.

Aspidium pteroides sensu Luerssen, J. Mus. Godeffr. 1:55, 1873, non *Polypodium pteroides* Retz. 1791.

Nephrodium parasiticum var. *multijugum* C. B. Clarke, Trans. Linn. Soc. Bot. 1:533, 1880. Type: Penang, Wallich 348.

Dryopteris extensa (Blume) Kuntze, Rev. Gen. Pl. 2:812, 1891.

- Nephrodium wakefieldii* Baker, Ann. Bot. 5:326, 1891.
Type: Mombasa, Kenya, *Wakefield*.
Dryopteris sulfurea E. Brown, Bish. Mus. Bull. 89:23, 1931.
Type: Marquesas, *Brown* 193.
Phegopteris pennigera sensu Hosokawa, Trans. Nat. Hist. Soc. Formosa 26:233, 1936, non *Polypodium pennigerum* Forst. f., 1786.
Dryopteris impressa (Desv.) Posth., Verh. K. Akad. Wettensch. Amst. 36(5):14, 1937.
Cyclosorus extensus (Blume) Ching, Bull. Fan Mem. Inst. Biol. Bot. 8:182, 1938.
Cyclosorus interruptus sensu Wagner and Grether, Occ. Pap. Bish. Mus. 19:50, 1948, non *Pteris interrupta* Willd., 1794.
Thelypteris extensa (Blume) Morton, Amer. Fern J. 49: 113, 1959.
Thelypteris interrupta sensu Stone, Micronesica 2:3, 1966, non *Pteris interrupta* Willd., 1794.
Thelypteris sulfurea (Brown) Reed, Phytologia 17:318, 1938.

Rhizome tending to be rather thick and short; fronds broad, oblong, pinnate; pinnae deeply lobed usually one-half to three-fourths the way to the midrib, the lobes tapering somewhat, the apex of fronds deeply pinnately lobed or pinnatifid in lower half strongly tapering to a caudate tip; sori submarginal around the lobes, appearing marginal because of revolute margins of lobes; yellow glands on lower surface of pinnae especially on veins and near tips of lobes.

SPECIMENS EXAMINED.—INSULAE OCEANI PACIFICI: *Forster* (BM) (a wilted specimen but probably this).

TUAMOTU Is.: Bow Island [Hao Atoll], *Barclay* 165(?) (BM).

MARQUESAS Is.: *Dupetit-Thouars* in 1843 (P, 2 sheets). Uapou I.: alt. 200 m, *Jones* 1105 (BISH, BM); Hakahetau valley above village, 25–250 m, common name: "Autapa'amei," *Decker* 2283 (Fo, US), Uahuka I.: Hannay, 150 m, *Jones* 1662 (BISH); *Jones* 1665 (BISH); Upper Ha'avei valley, 200–250 m, *Decker* 1469 (Fo); interior Vaipae'e Valley, 200 m, *Decker* 1537 (Fo), 1549 (Fo, US); Upper Vaipae'e, 170 m, *Decker* 1981 (Fo, US); west side of Vaipae'e, 100 m, *Decker* 1793 (Fo, US). Hiva'oa I.: 300 m?, *Brown* 793 (BISH, type of *Dryopteris sulfurea*); central Puamau, 85 m, *Decker* 801 (Fo, US); Puamau village, 25 m, *Decker* 883 (Fo, US); SW Puamau, 200 m, *Decker* 1011 (Fo); central Puamau valley, 2 km inland, 225 m, *Decker* 1080 (Fo); E. Puamau valley, 175 m, *Decker* 1133 (Fo); Puamau, along Puamau-Atuona trail, 500–650 m, *Decker* 1200 (Fo). Nukuhiva I.: Hakaui, *Brown* 790 (BISH); Taiohae, *Brown* 31 (BISH, 2 sheets); Taiohae-Hatiheu trail, 450 m, *Decker* 2170 (Fo, US). Fatuhiva I.: Omoa Valley, 500 m, *Brown* 987 (BISH); Hanavave, 100 m, *Jones* 1808 (BISH); s.l., *Cheesman* in 1925 (BM). Motane I.: 100 m, *Jones* 1725 (US, BISH). Eiau I.: 700 m, *Jones* 1515 (US, BISH). Tahuata I.: Vaitahu, 150 m, *Jones* 1745 (BISH).

SOCIETY Is.: Meetia I.: Fatia-Po to Fareura, 250 m, St. John 14189 (BISH).

AUSTRAL Is.: Rimatara I.: Stream near Mutuaura, 20 m, *Fosberg* 12053 (US, BISH). Rurutu: Moerai, 10 m, St. John 16636 (BISH); Puputa Valley, above Moerai, 25 m, *Fosberg* 11937 (BISH).

SAMOAN Is.: Tau: 1 mi. S Siufaga, 60 m, *Yuncker* 9020 (BISH).

BONIN Is.: Nakata-iōtō, *Tuyama* (reported by Itō, 1937: 714).

MARIANAS Is.: *Gaudichaud* (P, 2 sheets); *Gaudichaud* in 1824 (P). Agrigan I.: canyon on E side, *Fosberg* 31633 (US, BISH, Fo, MICH). Alamagan I.: s.l. *Falanruw* 1913 (US); 60 m, *Anderson* 412 (US, BISH, Fo, MICH, IJ, NY). Saipan I.: s.l. *Kanehira* 2229 (NY); *Hosokawa* 6659 (A); Raishingan, *Hosokawa* 8031 (BISH, A). Rota I.: Savana, *Hosokawa* 7593 (BISH, A), 7646 (A); *Necker* R 88 (US); 1300 ft, *Kondo* in 1952 (BISH); 800 ft, *Grether* 4470 (US); slopes above As Malote, S side of island, 250 m, *Fosberg* 31875 (US, BISH, Fo, MICH); NW coast of W end of main part of island, between Rota and Tataacho Point, *Fosberg* 25137 (US, BISH, Fo, MICH, IJ). Guam I.: *Mertens* (BM); *Wagner* 3292 (US); *Connover* 534 (US); *Herb. Richard* in 1824 (P); *Marche* 167 (P), 47 (P), 73 (P); Haputo Point, *Johnson* and *Necker* 1 (US); Mt. Santa Rosa, *Glassman* 172 (Fo); *Hosaka* 3151 (US, BISH, Fo); 1 mi. S of Taguac, on north plateau, *Fosberg* 35479 (US, BISH, Fo, MICH, IJ, NY); Agaña, *Safford* and *Seale* 1086 (US), 1088 (US), 1089 (US); Agaña Swamp, E of Agaña, 1 m, *Fosberg* 31226 (US, BISH, Fo, MICH, IJ, NY); 5 m, *Bryan* 1084 (US, NY, BISH); Agaña Marshes, *Grether* 3823 (US, BISH); lower Fonte River, 15 m, *Fosberg* and *Evans* 46197 (US, BISH); 2 km S of Piti, *Necker* 101 (US); shores of Piti Harbor, *Bartsch* 101 (US), 110 (US); Yigo, 180 m, *Bryan* 1139 (BISH); Lonfit River, *Grether* 3710-A (US); Sigua River Valley, *Grether* 3728 (US, BISH); near junction of Lonfit and Sigua Rivers, *Grether* 3817 (US, BISH); W of Mapao, 3 mi WNW of Talofifo Bay, 100 m, *Fosberg* 35455 (US, BISH, Fo, MICH, IJ); Talofifo, Mt. Almagosa, *Hosaka* 3184 (US, BISH, Fo); Umata, *Marche* 243 (P).

CAROLINE Is.: Sonsorol I.: *Berry* 1 (US). Palau Is.: E end Koror I., *Fosberg* 50631 (US, BISH); Tor Uil I., between Koror and Malakal I., 15 m, *Fosberg* 47598 (US, BISH); Aulupse'el I., 10–15 m, *Fosberg* 47556 (US, BISH, Fo, MICH, IJ, NY, L); E end of Urukthapel I., road to lighthouse, 1–5 m, *Fosberg* 32036 (US, BISH, Fo, MICH).

NEW GUINEA: Kaiser-Wilhelmsland, Wälder von Woble, 180 m, *Schlechter* 16349 (BISH). Rawak I.: *Gaudichaud* in 1819 (P); in 1845 (?) (P); *Gaudichaud* (P).

TIMOR I.: *Herb. Desvaux* (P, prob. type of *Nephrodium impressum*).

PHILIPPINES: Luzon I.: Prov. Laguna, Los Baños, Mount Maquiling, *Elmer* 17905 (BISH); Prov. Ilocos Norte, *Ramos* 7772 (BISH); Prov. Ilocos, Burgos, *Ramos* 27212 (US). Balabac I.: *Mangubat* 415 (NY, US). Mindanao I.: *Cuming* 293 (BM); District of Zamboanga, Santa Maria, *Reillo* 16501 (US).

MALAY PENINSULA: Ayer Hitam: *Matthew* in 1908 (K,

2 sheets); G. Pardok, *Matthew* in 1911 (KO). Negri-Sembilan: Lukut Fort, sea level, *Hose* 172 (K). Malacca: *Cuming* 391 (K, 3 sheets, one young, doubtful, US, P, isotypes of *Lastrea malaccensis* Presl, photo of Paris sheet in US, Morton Neg. No. 17450) [cited by J. Smith (1841: 411) as his *Nephrodium cumingii*]. Penang: *Wallich* 1829 (K), 348 (K, P, photos in US, basis of *Aspidium multi-jugum* Wall., Morton Neg. Nos. 17451, 17452), 355 (P, photos in US, basis of *Aspidium prionophyllum* Wall., Morton Neg. Nos. 17453, 17454); *Curtis* 3367 (K). Pulu Penang: *Blume* (photo in US of specimen in L, type of *Aspidium extensum* Blume). Kedah: Pulau Langkawi, *Holtum* 17414 (US); West Coast, Pulau Dayang Bunting (Pulau Langkawi) *Henderson* 29132 (US). Johore: *Vestral* 295 (US).

SINGAPORE I.: Blakang Mati I.: Sea level, *Molesworth-Allen* 2523 (US).

JAVA: Goenung Parang, *Blume* (BM).

THAILAND (SIAM): Murok Lek, *Marcan* 806 (BM); Bandon, Surat, near sea level, *Smith* 3004 (BM), 3007 (BM, US); Setun Puket P. Siam, *Smith* 2469 (BM, US), 2459 (US).

CEYLON: G. Wall in 1884 (PDA); *Thwaites* (BM); "Gandala," *Herb. J. Smith* 1106 (BM); Kandy, *Chevalier* [?] (BM), [Thwaites] C. P. 975 (PDA); s.l. ex *Herb. William Ferguson* 138 (US, 2 sheets).

CHAGOS Is.: Diego Garcia: Minni Minni, *Stoddart* 832 (K).

AFRICA: Kenya: Mombasa, *Wakefield* (K, type of *Nephrodium wakefieldii*, 3 sheets); Tanzania (as Tanganyika Terr.): Pangani, Tanga Prov., *Tanner* 2836 (K); Ulugurus, Kimbosa, 1000 ft, *Bruce* 133 (US, BM). Pemba I.: *Vaughan* 456 (K). Mozambique: Manica e Sofala: Cheringoma, Inhaminga, *Mendoza* 4377 (BM); Zambezia, *Mendoza* 1448 (BM).

COSTA RICA: Prov. Puntarenas: 6 km S of airstrip, Osa Peninsula, 500 ft, *Mickel* 2770 (ISC, LP, US).

MARTINIQUE: *Stehlé* 4986 (US).

BRITISH GUIANA: *Maguire* and *Fanshawe* 22983 (US).

COLOMBIA: Putumayo, 15 km NW of Puerto Asis, 1000 ft. *King & Guevara* 6222 (US).

ECUADOR: Santiago-Zamora, Taisha, 1500 ft, *Cazalet* & *Pennington* 7751 (US).

We have not been able to examine Chamisso's specimen, described by Kaulfuss as *Aspidium opulentum*, but the description is very clear and fits the species under discussion very well. This is the only species in Guam that corresponds to the Kaulfuss description, and there seems no reasonable doubt that the epithet *opulenta* is correctly applied here.

The type of *Nephrodium impressum* Desv., from Timor, is probably a specimen from the Desvaux herbarium in Paris which is this species.

Blume's description of *Aspidium extensum* generally fits; a specimen in Leiden, named in Blume's

hand, photographed by C. V. Morton (Neg. No. 1128), and considered to be the holotype by Morton, has the caudate pinnatifid apex of *T. opulentum*.

Nephrodium conioneuron Féé has usually been referred to *Dryopteris pteroides* (Retz.) O. Kuntze or *D. interrupta* (sensu auct., non *Polypodium interruptum* Willd.). The type has not been located by us. A comparison of the description of this and *Nephrodium oreopteris* Féé, published together, shows that *N. conioneuron* should have more deeply lobed pinnae than *N. oreopteris*. Isotype material of the latter represents one of the few intermediates between *T. opulenta* and *T. wagneri*. Its pinnae are more deeply lobed than those of *T. wagneri*. Since the pinnae of *N. conioneuron* are described as still more deeply lobed, it seems safe to refer *N. conioneuron* tentatively here.

Aspidium pteroides var. *a* Mett. was based on *Nephrodium conioneuron* Féé, and var. *b* Mett. was based on three synonyms, two of which, *Aspidium opulentum* Kaulf. and *A. extensum* Blume, belong here.

No descriptions were provided for *Aspidium terminans*, *Nephrodium terminans*, and *Nephrodium cumingii*. One of the two specimens cited with the latter, *Cuming* 391 from Malacca, is *T. opulenta*. The other, *Cuming* 293, from Mindanao, is probably *T. wagneri*, but the US specimen of this number is fragmentary and the determination doubtful. We have not seen the *Wallich* specimen of *Aspidium terminans*. Smith merely cites *A. terminans* Wall. and *N. cumingii* J. Smith as the protologue of *N. terminans*, hence it is also a nomen nudum, unless provided with a description in some publication missed by the indexers.

Ching refers *Nephrodium parasiticum* var. *multi-jugum* C. B. Clarke, Wall. Cat. 348, from Penang, to *Dryopteris extensa* (= *opulenta*), and our examination of Wallich's material confirms this.

The type of *Nephrodium wakefieldii*, from East Africa, certainly belongs here, but the material seen from there is very luxuriant and the pinnae are very deeply lobed. *N. wakefieldii* was reduced by Schelpe (1965: 266–267) to *Thelypteris extensa* (Blume) Morton, which belongs here.

We have seen ample material of *Dryopteris sulfurea* from the Marquesas, including that studied by Dr. Brown, and find no distinction from *T. opulenta*.

References of Guam material of this species to derivatives of *Polypodium pennigerum* Forst. f., of *P. pteroides* Retz., and of *Pteris interrupta* Willd. are simply misidentifications. The two latter are discussed elsewhere in this article. *Polypodium pennigerum* is a *Thelypteris* that superficially looks a bit like *T. opulenta*, but lacks yellow glands, has the sori differently disposed, and does not actually seem very closely related.

Thelypteris opulenta var. *hirsuta* (Ching) Fosb.,
new combination

Cyclosorus interruptus var. *hirsutus* Ching, Bull. Fan Mem. Inst. Biol. 8:186, 1938. Lectotype: Thailand, *Rock 1716*.

This differs from var. *opulenta* in the short pale pubescence of the underside of the frond. This pubescence is most marked in the *Rock 1716* specimen cited, here designated as lectotype. The *Smith 473* specimen is intermediate between *T. opulenta* and *T. wagneri* (see discussion below under *T. wagneri*).

Thailand, Prov. Chiengmai, Chieng Rai, lower slopes of Doi Chang Mt. near Hue San (420–1, 260 m, *Rock 1716* (US, lectotype, annotated by Ching)).

Thelypteris wagneri Fosberg and Sachet, new species

Polypodium pteroides Retz., Obs. Bot. 6:39, 1791, type: Ceylon, König; non *Thelypteris pteroidea* (Klotzsch) Tryon, Rhodora 69:8, 1967, which was based on *Polypodium pteroideum* Klotzsch, 1847; non *P. pteroides* Lam., 1778.

Aspidium pteroides (Retz.) Swartz, Schrad. J. Bot. 1800 (2):33, 1802.

Nephrodium oreopteris Féé, Gen. Fil. 304, 1852, type: Philippines, Cuming 48; non *Thelypteris oreopteris* (Ehrh.) Rydb., 1917.

Aspidium pteroides var. *b* Mett., Ann. Mus. Lugd. Bat. 1:231, 1864, pro parte.

Dryopterys pteroides (Retz.) Kuntze, Rev. Gen. Pl. 2:813, 1891.

TYPE.—Java, Raciborski in 1897.

Rhizoma repens, glabrum; frons oblonga, ad apicem abrupte contracta, segmento terminali pinnam simulante, pinnis lobatis lobis brevibus vix ad dimidium costae fissis, infra flavo-granulatis, soris submarginibus.

Rhizome slender, 3–4 mm thick, creeping, shortly

but rather densely hirtellous, covered by brown linear-lanceolate caducous scales; fronds widely scattered, long-stipitate, up to 1 m or more long, the stipes dark brown, minutely retrorse-hirtellous, clothed on basal several cm with brown linear-lanceolate scales, the blades pinnate, oblong, up to 50 cm long, abruptly contracted toward apex, the rachis lighter brown than stipe, hirtellous, the pinnae lance-linear to linear oblong, tapering in distal third to an acuminate tip, 13–28 cm long, 1–2.5 cm wide, the width and length varying independently, well separated, alternate, the lower sometimes subopposite or even opposite, the lowermost somewhat to rather strongly reduced on some specimens, these apparently early fronds in the development of the plant (*Smith 190, 299, Molesworth-Allen 2844, Merrill 594, Williams 2218, Otanes, 18728, Topping 659*), pinna lobed to about half or less the distance to the midrib, lobes obliquely rounded or obtuse to apparently acute but this because of the margins curving round sori, lobes appearing slightly falcate, pinna sparsely pilose above and beneath, especially on the veins, and densely so on upper side of costa, underside with yellow bulbous or globose particles or “glands” scattered on veins and especially near tips of lobes, 3 veins from each lobe uniting in a vein running to the sinus between 2 lobes, sori submarginal but appearing marginal because of the somewhat revolute margins, sometimes 1–3 pairs below sinuses but a broad sorus-free band along pinna-midrib, this rarely with a few scattered sori, distal two or three pinnae somewhat reduced, terminal one essentially identical with lateral ones, little dilated basally; indusium orbicular, somewhat hirtellous; annulus with 15 or 16 cells; spores bilateral, very deeply rugose with short curved or sigmoid ridges.

DISTRIBUTION.—New Guinea to Ceylon, west-central Africa (Oubangi), and Fernando Po Island in the Gulf of Guinea; most abundant in the Philippines, Malesia, and Indo-China.

SPECIMENS EXAMINED.—NEW GUINEA: Papua: Central Distr., near Douramoko Village, Vanapa River, 50 ft, Shodde 2637 (US).

HAINAN: Wang 33474 (US; very young wilted specimen, determination doubtful).

PHILIPPINES: Cuming 48 (US, isotype of *Nephrodium oreopteris* Féé?). Luzon I.: Rizal Prov.: Montalban, Loher 944 (US), Ramos 5203 (US); Antipolo, Ramos and Edaño 29542 (US). Tayabas Prov.: Edaño 26947 (US);

Atimorian, *Topping* 1310 (US), 1315 (US). Pangasinan Prov.: Umingan, *Otanes* 18278 (US). Laguna Prov.: *McGregor* 23111 (US); Los Baños, *Topping* 659 (US), 680 (US); Mount Maquiling, *Elmer* 17905 (US). Ilocos Norte Prov.: *Ramos* 7756 (US). Mindoro I.: Puerto Galera, *Ramos* 46426; Calapan, *Merrill* 984 (US) (in most respects this species, but the terminal segment slightly broader and more lobed at base than usual, thus tending in this character toward *T. opulenta*). Balabac I.: *Mangubat* 420 (US). Culian I.: *Merrill* 484 (US), 594 (US). Mindanao I.: Gulf of Leyte, *Cuming* 293 (US, doubtful, specimen fragmentary); Davao Distr.: *Copeland* 636 (US); Todaya, Mount Apo, *Elmer* 11, 111 (US, BISH). Zamboanga Prov.: Binalanay, *Copeland* in 1917 (US); San Ramon: *Copeland* 1604 (US), *Williams* 2436 (US); Sax River, *Williams* 2218 (US). Palawan I.: San Antonio Bay, *Merrill* 5254 (US). Sulu Is.: 8 mi SE of Cagayan, *Santos* 4677 (US).

MALAY PENINSULA: Kedah: Alorstan (Alor Sta.), *Ridley* 14764 (K); West Coast, Dayang Bunting, *Henderson* 29144 (K). Malacca: *Griffith* (K). Perlis: Kalu Bukit, *Kiah* 35250 (K); Bukit Ketri, *Matthew* in 1914 (K). Pahang: Ayer Besar, P. Tioman, *Henderson* 18767 (K, US). Penang: *Molesworth-Allen* 2844 (US).

SINGAPORE I.: *Lobb* 24 (K).

INDONESIA: Borneo I.: Banguey Is: *Boden Kloss* 19234 (US, BM). Java I.: Prov. Tegal: Between Pogal and Gerbo, 800–900 m, *Mousset* 15 (US, BISH); Tengger Mountains, Pogal-Gerbo, *Mousset* [Ros. Fil. Exs. 83] (US); Lebaksoe, *Raciborski* in 1897 (US, 2 sheets, type and isotype), in 1898 (US). Prov. Batavia: *Buyssman* 124 (US); Dessa Dramaga near Buitenzorg, *Schiffner* in 1893 (BISH). Celebes I.: Near Menado, *Nielsen* 754 (US, doubtful, very fragmentary).

INDO-CHINA: *Pierre* (US, 4 sheets); (poor material, determination doubtful).

CAMBODIA: Angkor, *H. M. Smith* 299 (US).

THAILAND: Singora: *H. M. Smith* 190 (US). Chanthabun: *Vesterdal* 477 (fragment, US). Gulf of Siam: Koh Tao Island, *H. M. Smith* 263 (US). Phitsanolok: Tung Salaeng Luang National Park, 500 m, *Tagawa* 11795 (US).

CEYLON: *Ferguson* 137 (US).

AFRICA: République Centre-Africaine: Oubangi-Chari, région de M'Baiki et Boukoko, *Tisserant* 1170 (P). Fernando Po I., *Vogel* (K) [possibly introduced].

Names based on *Polypodium pteroides* Retz. (1791) have usually, until recently, been applied to this species, and correctly. Then Ching (1933:566–568) confused the application of the epithet *pteroides* of Retzius by saying he had examined the type of *Polypodium pteroides* Retz., a specimen from Madras collected by König, which he says “really represents a species of the group of *Aspidium sagenioides* Mett. (*Dryopteris sagenioides* O. Ktze.), now considered as a free-veined tectorid fern, nearest to, or perhaps identical with *Aspidium fuscipes* Wall. or *Nephro-*

dium membranifolium Presl, both common ferns in Tropical Asia.” This, however, ignores the statement in Retzius’ description that the sori are marginal, and the fact that Retzius cited a König collection from Ceylon, not the one from Madras. Therefore, except for the possibility of regarding *Polypodium pteroides* as a later homonym of *P. pteroides* Lam. (1778), the epithet *pteroides* would have been available until 1967, when Rolla Tryon transferred *P. pteroides* Klotzsch to *Thelypteris*. Perhaps it would still be the correct epithet if the plant were regarded as belonging to another genus. However, it is unclear from Art. 73 of the Code whether *Polypodium pteroides* Lam. and *P. pteroides* Retz. (and *P. pteroides* Kl.) are or are not homonyms. If they had not been described in the same genus it might be possible to regard the epithets as different. However, in one genus they will certainly be confusing, and we choose to regard the three epithets as orthographic variants or at least as too close to be maintained under Art. 75.

If the *Cuming* 48 duplicate in the U.S. National Herbarium may be taken as an isotype of *Nephrodium oreopteris* Féé this name can be referred here with some hesitation. It seems rather intermediate between *T. wagneri* and *T. opulenta*, having the abrupt terminal contraction of the frond of *T. wagneri*, the pinnae more deeply cut but rather nearer *T. wagneri* in the shape of the lobes, and the terminal segment somewhat more deeply lobed at base than is usual for this species. In any event, the use of this epithet in *Thelypteris* is precluded by the combination *T. oreopteris* (Ehrh.) Slosson ex Rydb. (1917).

Mettenius based his *Aspidium pteroides* var. *a* on *A. conioneuron* Féé, his var. *b* partly on *P. pteroides* Retz. and partly on plants here referred to *T. opulenta*, and var. *c* on *A. obtusatum* Swartz, so it is just as well he did not name the varieties.

Since the names applied to this species are either unavailable or incorrectly applied to it, it seems necessary to propose a new name. We take great pleasure in dedicating it to Prof. W. H. Wagner, Jr., outstanding and profound student of ferns and teacher of botany. To avoid confusion, we have proposed it as a new species, rather than as a renaming of one of the old ones, thus attaching it to an extant type of which we are certain.

The boundaries between *T. wagneri* and *T. opulenta* are unclear in Thailand. The rhizomes of the plants cited as *T. opulenta* in Thailand tend to be

more slender and creeping than is usual in that species. The specimens cited below are variously intermediate in the shape of lobes and depth of lobing of the pinnae, the abruptness of contraction of the terminal portion of the frond, and the shape and degree of cutting of the terminal segment.

THAILAND: Wang-Djao, near Koh-Yai, *Hosseus* 89 (BM); Raheng, Nakawn Sawan, 150 m, *E. Smith* 3018 (US); Tap Sai, Chantabun, 200 m, *Kerr* 9604 (US); Prov. Udon, *H. M. Smith* 424 (US); Gulf of Siam, Koh Tao Island, *H. M. Smith* 256 (US). Khun Tai Mts., *H. M. Smith* 473 (US; annotated by R. C. Ching as *Cyclosorus interruptus* var. *hirsutus*); Sriracha, near sea level, *E. Smith* 3011 (BM); Sriracha, Nong Kaw, *Marcan* 1218 (BM).

Thelypteris interrupta (Willd.) Iwatsuki

Thelypteris interrupta (Willd.) Iwatsuki, Jap. J. Bot. 38: 314, 1963.

Pteris interrupta Willd., Phytogr. 13, Tab. X, 1794. Type: India, Klein.

Polypodium tottum Thunb., Prodr. Fl. Cap. 172, 1800. Type: Cape, Thunberg.

Aspidium obtusatum Swartz, Schrad. J. 1800(2):33, 1802.

Type: no specimen is mentioned, but probably the pinna in BM thus labeled by Swartz and discussed below is a fragment of what he described.

Aspidium goggilodus Schkuhr, 24 Kl. Krypt. Gew. 1:193, t. 33c, 1809 [spelled *goggylodus* on plate, usually corrected to *gongylodes*]. Type: Essequebo, from Gärtn.

Aspidium resiniferum Kaulf., Enum. Fil. 237, 1824. Type: Oahu [Hawaiian Is.], Chamiso.

Cyclosorus gongylodes (Schkuhr) Link, Hort. Berol. 2:128, 1833.

Dryopteris gongylodes (Schkuhr) O. Ktze, Rev. Gen. Pl. 2:811, 1891.

Thelypteris gongylodes (Schkuhr) Small, Ferns SE States 248, 475, 1938.

Thelypteris totta (Thunb.) Schelpe, J. So. Afr. Bot. 29:91, 1963.

Names based on *Pteris interrupta* Willd. have commonly been applied to one or the other of the two species described above, distinguished most readily from other similar *Thelypteris* (*Cyclosorus*) species by the tiny yellow particles or globules (glands?) on the lower sides of the lobes of the pinnae. However, while trying to separate and determine the correct names for these two plants, our suspicions were aroused by the similarity of Willdenow's plate to the common pantropical marsh fern usually called *Dryopteris* (or *Cyclosorus*) *gongylodes* (Schkuhr) Kuntze or more recently *Thelypteris totta* (Thunb.) Schelpe.

This possibility was dismissed as unlikely, since no one had ever suggested it in print, so far as we could determine, and the epithet *interrupta* was in common use for the other plants mentioned above.

While looking at plants of this affinity in the British Museum in 1968, we encountered a sheet on which were mounted three separate pinnae from the Swartz herbarium. One of these is labeled, in Swartz' hand "pinna ex Pteridis interrupta Willd. (ab ipso!)—mihi aspid. obtusatum." Another is labeled, also by Swartz, "Aspidium obtusatum Sw. prodr." Both of these are labeled in pencil, probably by Gepp, "D. *gongylodes* var. *proliferum*." Very careful examination shows no globular yellow particles, the venation of the lobes is of the peculiar ascending type and the undersurface has the sessile glistening resinous glands characteristic of what has been called *Dryopteris gongylodes*. These two pinnae belong to the hirsute form that is common over most of the range of the species. It seems clear that the pinna from Willdenow must be a fragment of the specimen on which he based his *Pteris interrupta*, and which he sent to show Swartz what this species was. This specimen was, presumably, one collected by Klein in India.

Dr. D. E. Meyer has very kindly sent a photograph of the Klein specimen in the Willdenow Herbarium in Berlin. This photo shows a plant with exactly the appearance of "*Dryopteris gongylodes*" except that the large pale scales sometimes found on the rachis do not show, unless some rather shadowy grayish blotches are the scales. The sheet bears an annotation, possibly in Willdenow's hand "Pteris sp. n.? Aug. 1794. Auf den Reise nach Madras. (Klein)" and another "Klein Ind. 1797 W," as well as annotations by Ching and Hieronymus. This sheet and another without a label but probably a duplicate are both numbered 19770 in the Willdenow Herbarium. They both bear the annotation in the upper right corner "Asp. obtusatum" "1a" and "1b," presumably added by Willdenow when informed by Swartz of their identity with his species in the genus *Aspidium*. Interestingly enough, the sheet marked "1a" has one pinna missing, probably that sent to Swartz.

Dr. Meyer also kindly sent a photo of the type sheet of *Aspidium goggilodus* Schkuhr, from the Schkuhr Herbarium. This consists of the drawing reproduced as t. 33c of Schkuhr (1809) and a pocket containing a single pinna, with the note "Durch Gärtn. aus Essequebo. Eine pinne habe an Mohr und Sw. ge-

sandt." Although Dr. Meyer says that "Aspidium goggylodus Schkuhr und Willdenow No. 19770 sind nicht identisch," they appear to belong to the same species. Schkuhr apparently later regarded his *A. goggylodus* as the same as *A. obtusatum* Swartz, since on a small ticket attached to the sheet bearing the drawing for his *Tab. 33b* he has crossed out "goggylod" and written "obtusat." Why this is on the sheet of this plate, which is his *Aspidium serra* is not clear.

In any event, there seems little doubt that the original material of *Pteris interrupta* Willd., *Aspidium obtusatum* Swartz, and *Aspidium goggylodus* Schkuhr belong to the same species, the common pantropical marsh fern. Willdenow's epithet was earlier and must replace the several later ones that have been applied to it, e.g., *totta*, *obtusata*, and *goggylodus* (*goggylodus*, *gongylodes*). The necessary combination was made by Iwatsuki and later by Stone (1967: 135), both under the impression that Willdenow's *Pteris interrupta* was the widespread species now to be known as *Thelypteris opulenta*.

For a pantropical species, *Thelypteris interrupta* shows remarkably little variability over most of its range. However, East African specimens exhibit considerable variation in depth of lobing of pinnae, scaliness, and the hairiness of the underside of the fronds. Material from Mafia Island is unusually hirsute; glabrous plants are found in Tanganyika, Zanzibar, and Pemba, as well as in South Africa, New Caledonia, and Tahiti.

Other African Species with Yellow Glands

The presence of yellow particles or glands on the underside of the fronds is apparently a rather uncommon feature in *Thelypteris*, so much so that their presence may cause people to refer quite unrelated plants to the species complex discussed above. *Thelypteris microbasis* (Baker) Tard. has abundant yellow glands, especially on the indusia. It is a plant with much more delicately cut fronds and does not seem especially related to any of the species treated in this paper. The only specimen we have examined is from Liberia, in the vicinity of Mount Coffee, Cook 12 (US).

Specimens from Uganda, at first referred to *Cyclosorus quadrangularis*, were, when found to have such yellow glands, tentatively placed by the collectors in

Cyclosorus extensus. The glands on this material, however, are not identical with those of the *T. opulenta-T. wagneri* complex. Mr. Robert Faden and Dr. K. E. Lye, of the East African Herbarium and Makerere University, respectively, have kindly placed the available material of this species at our disposal for study. This has enabled us to distinguish it clearly from the species discussed above and, hopefully, to indicate its relationship. Since it does not seem to have been described it is proposed as a new species.

Thelypteris fadenii Fosberg and Sachet, new species

TYPE.—Uganda, Lye 5186.

Planta terrestris, rhizomatibus repentibus, frondibus hirsutis ovatis ad basim non contractis, pinnis lobatis, loborum costulis infra glandulis clavatis vel fusiformibus aureis instructis, indusiis valde hirsutis.

Terrestrial plant with a creeping rhizome about 3 mm thick, this shortly hirsute and very scaly with lance-linear caudate caducous brown scales; fronds up to 100 cm long, irregularly disposed along rhizome from congested to 2–3 cm apart, the stipe pale dull brown, shorter than, to rarely as long as, blade, the longest stipe seen 50 cm, the bases of stipes hirsute and scaly with large glossy brown caudate caducous scales, the scales at first abundant, on old fronds scarce; blades up to 48 cm long, narrowly ovate in outline, broadest at base or the basal pinnae slightly shorter and spreading to more or less deflexed, without reduced pinnae, narrowed apically to a caudate basally pinnatifid terminal segment, fertile almost to tip in large fronds; pinnae 16–18 well-developed pairs, subopposite to alternate, linear-lanceolate, acuminate, up to 13.5 cm long, up to 1.8 cm wide, lobed to 7 mm or even deeper, the lobes very slightly falcate, rounded to almost obliquely truncate at apex, hirsute on both surfaces, beset beneath, especially along costae, with abundant or rather sparse clavate or fusiform to rarely bulbous or globular golden brown to rarely pale yellowish glands, these glossy and translucent, appearing resinous; one pair of veins united below the sinus into a single vein ending in the sinus; sori about one-third in from margins of lobes but sometimes appearing submarginal because of the revolute lobe margins, rather closely set along the sides of the lobes, absent from the tips, sparsely scattered to abundant on united part of pinna, on most fronds reaching to near midrib, on some reduced to one or

two pairs per lobe, these then near midrib; indusium well developed, orbicular-reniform, prominently long white hirsute.

Found in Uganda, on forest floor in West and East Mengo districts; one specimen, incomplete but probably this, from St. Helena Island.

AFRICA: Uganda, West Mengo District, Kyadondo County, Kampala, Makerere University Hill, 1200 m, K. E. Lye 5186 (MHU, holotype, isotypes, US, EA, NY, UC, GH, BM, K, P, G, B, MO); Cooper 2 (MHU, sterile, yellow glands very pale); Mawakota County, Mpanga Forest Reserve and Research Station, 1150 m, Faden, Evans & Lye 69/998A (EA), Lye et al. 3822 (MHU; yellow glands pale and not abundant). East Mengo District: Kyagwe County, Ssezzibwa Falls, 10 km W of Lugazi, 1200 m, Faden & Evans 69/985 (EA, US).

ST. HELENA I.: Quelle, Rosemary, *Just* in 1901 (US).

The St. Helena specimen consists of only two blades and agrees in all respects, including the clavate golden glands, with *T. fadenii*, although the distribution seems unlikely.

This species seems without doubt closest to *Thelypteris quadrangularis* (Fée) Schelpe (*Dryopteris contigua* Rosenst.), in fact, so close that it might be regarded as a variety of it. It differs in its creeping rather than erect rhizome, more scattered fronds, shorter and broader lobes of the pinnae, and especially in the clavate to fusiform golden glands. As species go in tropical *Thelypteris*, this seems sufficient to justify specific rank for *T. fadenii*. A considerable series of Brazilian *T. quadrangularis*, determined by Alan Smith, and a series from Africa, not so uniform but agreeing in most essential characters, were examined, especially for glands. Some of the Brazilian specimens, especially three from Viçosa, Minas Gerais

(*Mexia* 4487-a, 4760, and 5498-a, all US) and one from São Leopoldo, Rio Grande do Sul (*Leite* 4282, US), have scattered to abundant tiny white particles on the undersurface of the lobe tips. A sheet from São Bento, Bahia (*Luetzelberg* 271a, US), has such particles and a few tiny globose pale to brownish glands. These could be regarded as approaching *T. fadenii*, but the "glands" are much smaller and not the same shape, and the other characters are those of *T. quadrangularis*.

These two species do not seem particularly related to the *T. opulenta-T. wagneri* group, nor to *T. interrupta* (*T. goggilodus*, *T. totta*), but perhaps more so to *T. dentata* (Forsk.) E. St. John and *T. parasitica* (L.) Tard.

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